

T O T H E
Honourable LORD WARDEN,
A N D
A S S I S T A N T S
O F
DOVER HARBOUR.

The Report of JOSEPH NICKALLS, Engineer, (made in Obedience to an Order received at *Walmer Castle*, Sept. 2, 1775) on the said Harbour. Together with a general Plan of the same, and of such other Works as appears to me the most proper, for rendering it a complete Artificial Harbour.

L O N D O N:

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Honourable Lord WARDEN.

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The Report of Joseph H. ...
an Order received at ...
Harbour. Together with a general Plan of the same, and of two
other Plans as appears in the said papers, for building a
complete Harbour.

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O F
D O V E R H A R B O U R.

THE Report of *Joseph Nickalls*, Engineer, (made in Obedience to an Order received at *Walmer Castle*, September 2, 1775) on the said Harbour, together with a General Plan of the same, and of such other Works as appears to me the most proper, for rendering it a complete artificial Harbour.

On which Plan, conformable to said Order, are pointed out the particular Works already done, and those now in Hand. Viz. a Wall was ordered to be made in the Outward Harbour, from A to B; but as the Timber Work had failed from C to D, I was instructed first to compleat that Length, which is now done. The Timber Work from B to E in the Cross Wall, being in a very bad State, I received Orders to proceed next with that, and this also is now nearly finished.

To the End that, the Motives for the additional Works laid down on the Plan, and that the Observations which I have made in the course of my Employment under the Honourable Board, may be the better understood, it may be proper to
state

state, that from Accounts thereof, collected by Mr. *Hammond*, of *Dover*, (with the reading of which he was so obliging as to favour me) it appears, that the Situation of *Dover* Harbour, has from very distant Periods of Time, been considered as a very great National Object, as necessary for the Intercourse of the Pacquets between *England* and *France*, and as a Reception for the small Ships of the Royal Navy, both for Safety and Repairing, and for Trading Vessels at large; and that in the course of many Ages, prodigious Sums of Money have from time to time been expended upon it, in Endeavours to keep it open, and render it a commodious Harbour; but that after all these repeated Expences and Endeavours, it still labours under such Circumstances, as in a very great Degree renders unsuccessful all that has been done.

It appears likewise from the above Accounts, that the Entry has been in different Places, and that in every Situation, the Mouth has many Times been entirely shut up by the Beach, which has always happened from the same Cause: viz. the vast Quantity thereof that is driven along Coast-ways by South-Westerly Winds; and as the Harbour is situate in a Natural Bay, in which the Beach is less impelled by the Winds, than on the open Coast, and being there in a State of Rest, the Mouths were filled with Beach, in all the former Situations, in common with the whole Bay. And it also appears that the Changes of the Mouths has happened from the Water, pent up by the Beach, making its Way through the same in different Places, at different Times.

The Harbours Mouth having undergone, in the course of many Ages, such various Changes, it appears from the above Accounts, that the first notable Step taken to remedy the Evil, was, by running out two Piers South East, many hundred Feet from the Bottom of the Bay, as represented in the Plan by the bold dotted Lines. After this great and expensive Work, the Bars still formed to such Size, that it often happened, that there was not more than four or five Feet Water over them, and sometimes a total Stoppage at High Water Neap Tides.

The next Method pursued was, that of making an Excavation for a Reservoir (marked P on the Plan) called the Pent, for storing up the Tide and River Waters,
and

and in that Work Sluices were provided for the Purpose of letting go in full Current, the Waters so retained, for scouring away the Bars, when formed at the Mouth of the Piers.

The Means were still inadequate to the preventing or removing the Bars which still formed, and oft Times remained till a Change of Wind removed them; and as the Pent was not made deep enough for the Reception of Ships; therefore, when the Tides were ebbd out, the Vessels were all left aground: This Evil, and the Insufficiency of the Water Pent up for doing the Business, led, after many Years, to the next Work, which was that of forming a Bafon (marked B on the Plan) for Ships to ride in afloat, and increasing the Quantity of Tide and River Water to be pent up, for the Purpose of removing the Bars. This Bafon was formed below the Pent, by means of the Cross Wall, in which is an opening of about thirty-eight Feet wide, furnished with a Pair of strong Gates pointing to Landward, for the Purpose of retaining the Water, and of letting Vessels into and out of the Bafon at high Water, and with Sluices for letting off the Water contained in the Pent and Bafon, for the Purpose of removing the Bars.

After all these expensive Attempts, the Bars still formed, and were superior to the Means provided to prevent or remove them, except at or near the Top of Spring Tides, and as the Evil still remained, other Means were wanted, and sought after; and the next Method pursued was that of a Turn Water, as it is called, which was a Floor made upon the Bed of the outward Harbour, pointing from the East, towards the Head of the West Pier, as represented by two dotted Parallel Lines in that Direction; and in it Posts and Boards were applied as a Means of pening up the Water, by contracting its Passage, and thereby throwing it more forcibly against a particular Part of the Bar, to cut a Passage through it, and by disuniting its Parts to make it remove the easier; this, with the aforementioned Works, have been the Provisions made for keeping clear the Harbour; but after all the Evil still continues.

From the Situation being such, that a good Harbour there must be of inestimable Value to the Nation, it still led to other Pursuits; and the next Method re-

commended was that of erecting Jetties along the Coast, to the Westward of the Harbour, by Means of which it was imagined that the Quantity of Beach that would then reach the Harbour's Mouth, would be much less than before; and this appears to have been pointed out by the Effect that was observed to arise from large Quantities of Chalk, that had fallen from the very high Cliffs, and formed great Projections, or Promontories, into the Sea; which, during their Continuance, (some of which lasted for many Years) the Harbour's Mouth was not annoyed by so many nor so large Bars, as when they did not subsist; it was likewise observed, that the Effect was immediately after the Falls happened, and that the Bars began to increase in Size and Number, in Proportion as the Sea washed away those accidental Jetties; this had happened repeatedly, and it was judged that their Effect was in Proportion to their Size and Distance; and as these Falls were accidental, and their Continuance uncertain, it was determined to apply artificial ones, which would be more permanent. The largest of these was called *Cheefman's Head*, as marked on the Plan; this Work, as is attested by many, produced a similar Effect with the accidental ones; for while it remained entire, the Bars were neither so numerous nor so large, as when there were neither this nor the accidental ones; and that the running the Water for scouring them away, had much better Effect in keeping open the Mouth of the Harbour, than when neither kind subsisted. This Head having been Built with Timber, had suffered much by Time, and was nearly destroyed; when my Employment began at *Dover*, and it being stated to the Honourable Board, that for want of it being entire, the Harbour was much annoyed by Bars, on which I received Orders for erecting it with Stone, which has been done some Time; and I am certain, that the Bars are neither so numerous, nor so large as while it was in that ruinous State; from which I infer, that was it totally away, the Harbour's Mouth would in strong South Westerly Winds, be nearly constantly so stopped, as to render it impassable for Vessels drawing Six or Seven Feet Water.

Notwithstanding the above-stated expensive Efforts towards a Remedy, the Evil still continues in so great a Degree, that should a Vessel go out, or come into the Bason, two Days after the Top of Spring Tides, as the Water in the Bason must be lowered conformable to that Tide, and generally the Water in the Pent also;

that

that if a Bar should form the next Day, and the forming Wind continue till the next Springs, the Harbour must be bared till that Time; except the small River that comes in at the upper End of the Pent, should fill the same, and the Bason, sufficiently to remove the Bars, when let go in the usual Manner; but by the injudicious Construction of the Foundations, and other Parts, so much Water leaks away, that the Stream in short Waters, scarcely produces more than once or twice between Spring and Spring, a sufficient Quantity for that Business; and in Spring Tides, when the Pent, Bason, and River Water have been all let go, with the Turn-Water set, (which is using them all with their fullest Power) I have seen two or three successive Runnings of the Sluices, that could not make a good Harbour, as 'tis called, that is, not fully remove the Bar, although it was not one of the largest Size.

As the Remedy for this Evil is, as I apprehend, the grand Object that has been so long fought for, and as nothing hath been done, nor that has come to my Knowledge, any Proposition made, which in my humble Opinion would effectually prevent the Bars forming; or, if by extreme Winds, any should form, that would then effectually remove them the next Tide, either in Spring or Neap; I shall assign my Reasons for that Opinion, and then proceed to explain my Design, and why I presume it will answer effectually the desired End.

Captain Perry, in his Report on *Dover* Harbour in One Thousand Seven Hundred and Eighteen, advises carrying the West Pier Head One Hundred and Fifty or Two Hundred Feet further into the Sea, without extending the East Head: this would certainly have been productive of lodging the larger Bar in the Eddy that the Projection would have occasioned, and no Boundaries being provided to the Beach on the North East, the Effect of running the Back Water for removing the Bar, would certainly have been less than when bounded by the two Piers; for that Reason, I disagree with the Proposition. He likewise recommends Jetties, as an effectual Means or Remedy, to which I can by no Means agree, but acknowledge them to be useful in Part.

Mr.

Mr. *Smeaton*, in his Report in One Thousand Seven Hundred and Sixty-nine, recommended an Extension of the West Pier Head, about sixty Feet farther into the Sea, to be done of a particular Figure, for projecting farther into deep Water that Beach which might happen to be drove against its southerly Face. It appears to me, that so far as Figure and Direction are necessary in the Case, that he has determined on the most eligible, and I have applied it to my West Head, but differ from him, respecting the projecting one Head so much, and the other not any, for Reasons before given. He likewise advises the not repairing of *Cheefman's Head*, and says, that while this was doing, the good Effects thereof to the Harbour was experienced; but being now in a State of Decay, the Beach it formerly retained is coming down, advises the Discontinuance thereof, as not tending to the immediate Relief of the Harbour; but as that Head had then been erected near fifty Years, and it is allowed, that during the Time it was entire, the Bars were fewer, and of less Size, than while it was in a State of Decay, and that the Increase of Bars kept Pace with its shortening by Decay. These being Facts, I am led to differ with him in Opinion in this also. The next Thing recommended by him was, a hastier Discharge of the Back Water, thereby to produce a superior Effect to what is now done at Neap Tides, for removing Bars; to which I dissent, being of Opinion, that no Mode whatever of discharging it at those Times, can remove the Bars, the present Quantity being inadequate thereto, as will appear hereafter.

Having stated in general the Evils that have for many Ages attended this Harbour, and the Disappointments its Patrons have met with, and the various Methods already practised, as well as those proposed, which, if executed, could only tend to a partial Improvement, shall beg Leave to observe, that it is to me clear, that were as many more Methods to be applied, at as immense an Expence as has already been incurred, and that could the Harbour, by this Means, at all Times be kept entirely clear from Bars, that then, except a much greater Depth of Water were to be obtained, it would not answer the Expence as a national, but only as a partial Object; and as the Necessity of a Harbour, on the Coast, between the River *Thames* and *Portsmouth*, to which Ships could at all Times find Access, and when in, constantly ride afloat, and that in a more particular Sense in the Vicinity of the Downs, has at all Times been, and is universally acknowledged and wished for, both for the Safety
and

and repairing of the Royal Navy and Trading Ships at large, as well for the Importance of such in a *Frenth* War, both for King's Ships and Cruisers: it is needless for me to say any more thereon, but only to observe, that *Dover* Harbour, under its present general Disposition, cannot be made such, except for small Vessels, there being not more than ten Feet and a Half of Water, over the Cell of the Cross Wall, into the Bason at Neap Tides; and as Storms and contrary Winds do as frequently happen at Neaps, as at Spring Tides, I therefore cannot estimate any Harbour, but, by its acceptable Depth of Water, and Clearness of the Mouth at Neap, or very few Tides before and after.

Shall now proceed to explain the Construction and Use of the present Harbour, in which P is the Sheet of Water, called the Pent, whose Boundaries at Spring Tides, are described by the crooked dotted Line, between P and A, and the Wall 21, and Buildings extending therefrom, up to the three Gun Battery, which from its Narrowness at the upper End, its Declivity both Lengthways and Sideways, and from the Works at 16, which let in the Tide Water, being laid so much higher than those in the Cross Wall, and indeed, but about six Feet lower than the Top of a Neap Tide, that it, with the Bason B, as I find by an actual Measurement, contains at Neap Tides, for the Purpose of scouring away Bars, only Forty-seven thousand one hundred and sixty-four Tons of Water, and could the whole Contents be let go instantly, the Dimensions of the outward Harbour and Bason is so great, that they would not be covered two Feet and a Half deep, which must appear at first Sight, under any Mode of discharging them, to be inadequate to the Purpose of removing Bars at Neap Tides; therefore, should a Bar then form, it must remain, and the Harbour be blocked up, either, till the Wind or the next Spring Tides become the Means of removing it, the latter of which we will suppose is now arrived, and the Pent and Bason Water shut in, and retained till low Water, and that the Turn-water is set, in order to apply the Back-water with its fullest Power. As the Quantity of the Back-water in that State amounts to no more than One hundred forty-two thousand and thirty-three Tons, should the best Method of constructing Gates for a hasty Discharge of the same be applied, and thereby the Water let go in the quickest Manner possible, the Surface of the Bason and outward Harbour being such, that the Water would not rise to an effective acting Head

of four Feet, it must appear to be very insufficient for the Purpose, and that for the following Reason, having been seen, as before observed, by the present Means of letting go that Quantity of Water at Spring Tides, that after two or three successive Runnings of the Sluices, a good Harbour, as it is called, has not been made, viz. the Bar not entirely removed, although it was not one of the largest Size; It is therefore certain, that no Means whatever of discharging the Neap Tides Water, that can be obtained by the present Construction of the Harbour, can effect the Business of removing Bars, and that some other Construction is therefore wanted, to prevent, if possible, and to remove with Certainty, such as may happen. Shall therefore proceed to explain the general Plan, hoping to point out the Possibility of preventing, and the Certainty of immediately removing them, should any then form.

Explanation of the general Plan, for the Purpose of keeping the outward Harbour and Mouth clear from Beach.

P, as has been observed, is the Sheet of Water, called the Pent, to which it is proposed to add the Part A, which together will amount to seventeen Acres, and as the lowest Part of the present one is four Feet and a Half higher than the Cell of the Cross Wall of the present Basen B, by which at Neap Tides no Vessels can get into it, and at Springs none but of very small Draft, which reduces its Use to the simple Purpose of a Reservoir for scowering conjointly with the Basens Water. 'Tis proposed that the Whole should be sunk to four Feet below the Level of the Cross Wall Cell, and that by Means of the Lock 13 (to be used for passing Ships into and out of the Pent, as Barges pass on Navigations) the Water should be kept in the Pent to four Feet higher than Spring Tides, for the Purpose of riding large Ships, and retaining Water for scowering away Bars; 'tis likewise proposed to keep the Water in the present Basen B, and the Royal Basen R, to the same Height as in the Pent, and in the designed Basen D, to the Height of Spring Tides only. For the following Purpose, suppose a Bar to form at Neap Tides, then the Contents of Basen D only will be applied for removing the same, and the Power thereof will be near four Times greater than the present at such Tides, and will be near one and a Half superior to the present Power at Spring Tides,

besides

besides the more effectual Means of using it. We will now suppose it to be dead Neap, or the lowest Tides, and that the Water has been run, and the Bar not effectually removed, but that 'tis necessary to repeat the Operation the next low Water, as the Basen D. will by such Tide only take in ten Feet and a Half of Water, therefore the Quantity of five Feet and a Half, needful to make it a Spring Tide, must be drawn from the Pent P, the present Basen B, and the Royal Basen R, out of what they contain more than the Height of a Spring Tide, and by this Means the Basen D. may at each Tide be supplied with a Spring Tides Water through a whole Set of Tides, from Neaps to Springs, and Springs to Neaps; this Means of making Spring, arises from the Quantity contained in those three Reservoirs, the Pent, present and Royal Basens being filled by the Rivers Water to that Height, when their Assistance to the Basen D is not wanted, and at the same Time that the Basen is doing the Business of removing Bars; 'tis to be observed, that besides the Quantity of Water contained in Basen D at Spring Tide-Height being much more than the Pent, and Basen at present contains at Spring Tide, that the present outward Harbour is near twice as large as the proposed one, that therefore the same Quantity of Water, let go by the same Means, must produce a much greater Effect: we will now consider the Application of the Water by a more effective Means.

By supposing that a Bar has formed, and that the Water contained in the Basen D, should be drawn for the first Running, and being supplied after with a Spring Tides Water, by the Means above-stated, and that it passes through the Conduits marked *x, x*, in the proposed Piers *o, o*, with such Velocity, that Ten Thousand Ton pass in a Minute, which they will be capable of discharging, the Velocity being multiplied into the Quantity, the Power thereof must be considered as almost immense, compared with the present Mode of discharging the Water; and as this Method will have the following Means peculiar to itself, for the Purpose of removing Bars, viz. by directing the Force of the Water from End to End of the said Bars, and thereby dispersing them. Suppose the Harbour's Mouth barred up quite across, and that the Sluices in the West Pier should run Five Thousand Tons, or any needful Quantity, per Minute, to make, and that it has made a Breach in the North East End of the Bar, then, from the Direction in which the Water goes to the Bar, it must appear Self-evident at first View, that if the Sluices be so drawn,

as to let an equal Quantity of Water pass through the Conduits in the East Head, with that which is running through the West Head, the Direction of both, or Ten Thousand Tons of Water per Minute would be brought to the Middle of the Bar, and that the Action of the Water upon or against the Bar may be varied in Proportion to the Quantities that are running through each of the Piers, and thereby the Whole of the Bar scoweted away from End to End, without the Assistance of a Turn-water, and in a much more effectual Manner than by any Means now in Use for such Purposes. 'Tis presumed, that what has been stated must amount to a Proof, that the Water provided, and the Application thereof obtainable by the general Plan, must be a Means of a clear uninterrupted Mouth to the Harbour: shall therefore now proceed to consider the Means of keeping clear the Whole of the outward Harbour, as being an Object of vast Importance, and seldom much attended to in the Construction of these Kind of Works.

We will now suppose that a considerable Quantity of Beach may by some particular set of Wind, be brought into the outward Harbour, and consider how far a Remedy to such an Evil is to be obtained by the general Plan, admitting a Bank or Beach to be lodged alongside of the West Pier, then by running the Water through the Gates of the Lock 3, and its Side Wall, it must inevitably be cleared away; and should such Bank be formed on the other Side, then, by running through the Lock 2, and its Wall, the Bank must be removed in like Manner; and should one form in the Middle, or any other Part, it must, by running the Water through the Head Wall, be drove away; but supposing that these Operations should only dislodge the Beach from those Places, and carry it towards the Mouth, in that Case, should the Spring Tides Contents of the Basin D, amounting to One hundred fifty six thousand four hundred and forty two Tons of Water, be insufficient for clearing the Whole, then the Contents of the Pent P, Basin B, and Royal Basin R, or any Part may be applied, amounting in the Whole to upwards of Eight hundred thousand Tons, whence it is demonstrable that an unbarred Mouth, and a clear Outward Harbour may be obtained by the Means laid down in the General Plan.

We will now consider the Construction of the General Plan, for obtaining a much greater Depth of Water, and as a Means likewise of preventing Bars. In the
Section

Section, the dotted Line 3, represents the Height of the lowest Part of the present Pent, being about four Feet and an half higher than the dotted Line 2, which represents the Cell of the Cross Wall of the present Bason, below which I have seen Spring Tides Ebb near six Feet, that is down to the Water Line at V; to two Feet and an half below which, or eight Feet and an half lower than the dotted Line 2, it is proposed to lay the Cells of the Head Wall (so marked on the Plan) and of the Locks 2 and 3, on the Plan, and all the Passages into the Bason D, and Royal Bason R, by which nineteen Feet Water at Neap Tides, and twenty-four Feet and an half at Springs, will be obtained into all those Works: but as to this it may be objected, that laying the Foundation so low might be very expensive, if not impracticable; to which I answer, that to some hundred Feet of Quay, already done from C to E on the Plan, the Foundation is laid near eight Feet lower than that of the present Works, as represented by the Wall 1, on the Section, and it was found, that if needful, the Foundation might have been laid many Feet lower, without much increasing the Expence attending the same; this I did, thinking that some Time or other, the Harbour might be improved, and judging it my Duty in that Employment, not to ground my Judgment in Matters of so great Importance, on meer Opinion; it may likewise be urged against laying the New Works so low, that if Bars should form at Neap Tides, that the Water let go to remove them, will be resisted very much by the extra Depth of the standing Water; to which I answer, that the efficient Power of running Water, is resisted by stagnant, in such Ratio to their Heights and Depths, that in this Case, the Quantity and Mode of Application being considered, the Power of removing the Bars will be increased. Next, my Reasons for extending the Piers o, o, so much as two hundred and fifty Feet further into the Sea, than the present are, first, to obtain for Ships entering the Port, a sufficient run, before they arrive at the Head Wall, to the designed Bason D; and secondly, That the Shore being much leveller, and the Current less, near the present Heads, than it is two hundred and fifty Feet further out; and as all Matter specifically heavier than Water, (as is the Beach) will be less forcibly conveyed along Shore, in shallow, than in deep Waters; the Intent therefore of this Projection, is not solely to retain a greater Quantity of Beach, nor, by any particular Figure, to shoot it into deeper Water, clear from the Entry, but by carrying the Heads so nigh the Verge of much

deeper Water, to get nearly or entirely clear of it, by forcing it into the deeper and stronger Current, as may be seen on the Section, where S is supposed to represent the Cells of the proposed Works, and P the additional Projection of the Piers, and V the Verge or Termination of the shallow Water, and D the hasty descent or deepening of the same, into which the Beach, being by any Means thrown, I apprehend the Formation of Bars must be prevented, and that they can by no Means whatever happen in future.

Having in some former Part of this Report observed that the repairing of *Cheefman's Head*, had the Effect intended in lessening the Size and Number of Bars, shall now observe that the dotted Lines at the North End of that Work on the Plan, represents the Timber Work thereof which still remains, and that the Space between that and *fig. 1*, is the Stone Work done under my Direction, some Years since, from which the Effect before stated was found to arise, and am certain that the Effect was found instantly, and still continues, although it has been charged with Beach for Years. From 1 to 2 is a Length that has been in Contemplation to be added, although the Piers should not be extended; and should the General Plan be executed, then, from 2 to 3 is proposed as an additional Length, to keep Pace with the Extension of the Piers; and there is another important and useful Effect, that is known to arise from that Head, which is, that Ships coming for the Harbour under certain Winds, find an Eddy, or Slack of Tide, between it and the West Pier, which enables them to bring up, and thereby make the Harbour much better and safer; and it is well remembered that soon after the Repair was done, one or more Vessels were known to be saved thereby.

'Tis acknowledged to be the Duty of Military Engineers, to make every Part of a Work as tenable as possible, so it is the Duty of Civil Engineers to provide for keeping clear every Part of a Harbour, by some other Part; for otherwise either the Intention is not obtained, or a considerable running Expence entailed on the Works, as has been experienced at *Dover*; for according to Records, from One thousand seven hundred and twenty-seven, to One thousand seven hundred and thirty-two, as much Mud was taken out of the Bason and Pent, as made room for many thousand Tons of Water, at an Expence not much less than Two thousand Pounds;

Pounds, and it is certain that their present State is such, that to clean them both well, would cost many Thousands, there being no Provision made for clearing the Pent, but by Carts and Barrows; nor indeed, but a very injudicious one for cleaning the Basen; for the Water let go from the Pent, only clears a narrow Channel down to the Cross Wall: attending to these Evils, have provided that each Part shall want cleaning as little as possible, and that when needful, each Department shall cleanse the other; and to prevent the Evil that would arise by constantly receiving into the Pent, the Waters of the River, which coming from the Chalk Hills, North of *Dover*, bring down, after hasty Rains, great Quantities of Silt, which would subside soon after the Water should become stagnant, and thereby hastily rise the Bed of the Pent, (as it now does) it is proposed at such Times to conduct it by the Channel 17, leading from the Mill to the Duct 18, and by Means of the curved Duct 12, into the Conduits in the East Pier, and so to Sea, and in its clean State to go into the different Departments. We will now suppose, although every Precaution should have been taken to the contrary, that the Pent P now wants cleaning, for doing of which the Basen B is emptied, and the Basen D and R are both kept full; then the Water is brought from D through the Sluices 19, on the South East Side, and at the End of the Pent; and from R is brought through the Sluices 21, and the scowering Water, with the Sediment, from the End and Sides, passes through the Sluices 14 and 16, into the empty Basen B, and pass through the Dock 11, and to Sea by the Duct 12. Thus the Pent may be kept constantly clear of Sediment, at an Expence not to be noticed.

The Pent being full, and the Basen D empty, the Royal Basen R is to be cleansed in the following Manner; the Pents Water is let through the Sluices 21, and conveyed by Channel 22 to the Sluices 23, into the Basen R, the Lock 8 being open, the Sediment and Water passes through the same, and the Basen D to Sea, and the present Basen B is cleaned by the Sluices 14 and 16, and from the pointed Gates of the Lock 13; and the Basen D is cleansed by the Waters of the Basen R, through the Sluices in the pointed Gates in the Lock 8, and of Basen B, through the Sluices 6 and 7 in the Cross Wall, and the Water of the Pent through the Duct 18; thus

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it appears, that a certain, and the least expensive Method is provided for keeping the Whole clean; and as no Doubt can arise, but that there will be Times in each Year, that the Harbour will have but few Ships in it, those will be the properest for doing this Business.

It having been observed, that 'tis proposed to make the Bottom of the whole Pent four Feet lower than the Cell of the Cross Wall; 'tis to be noted, that the Sluices 14 and 16, and the Dock 11 and Duct 12 are also to be laid to the same Depth; and that the Sluices 7 in the Cross Wall, are laid between three and four Feet lower than the same, with this View, that all the Sediment in the Basen B. should pass through those, and not interrupt the shutting of the great Gates 5, as it does now, and that as a Provision, if at any Time this general Plan should be carried into Execution, then the present Basen B. might be sunk three or four Feet lower, leaving a Ridge all round in the Front of the Quays and Wharfs, which would be a Means of such Ships as might happen to be in it, not grounding so hard, when the Water is drawn from it, down to a Spring Tide's Water, as a Supply to make Spring Tides in Basen D, for the Purpose of scouring away Bars, &c.

Having pointed out a Means to obtain a good, safe, deep, capacious and clear Harbour at *Dever*, shall now proceed to explain the Use of each Part for the Reception of Ships, as it must appear clear at first Sight, that every Basen Harbour that is unprovided with a Lock or Locks, must, every Time a Vessel (great or small) passes in or out, level the Water in the Basen with that at Sea, and therefore; if a Vessel makes such a Harbour after the Tide has ebbed any, though very little, she must either ground till the next Tide, or the Water in the Basen be drawn down, which is scarce practicable; but if it was, it might injure many Vessels within, by grounding; and if Ships get into such Harbour at Spring Tides, either the Water must be lowered in the Basen conformable to the Sea, or they must lye till the next Springs; and upon the Whole, 'tis an unpardonable Neglect in any Engineer in not designing Locks, for the Passage of Ships or other Vessels into and out of the Basen at all Times, when they can have Access thereto. We will now suppose all the Reservoirs or Basens to be full to four Feet above a

Spring

Spring Tide, for Purposes before-mentioned, except Basen D, and that to be only Spring Tide full; then, as has been observed, there would be twenty-four Feet and a Half in it and the Royal Basen R, and twenty Feet in B and P, and that a sixty Gun Man of War is arrived at the Lock 3, and a large Merchantman at the Lock 2, and that 'tis a Spring Tide which has ebbed one Foot, that each goes into the Lock, and the Tail pointed Gates are shut; they then pass as Barges on a Navigation, by drawing the Sluices at Head, and filling the Chamber of the Lock to a Level with the Water in Basen D; the King's Ship wants some Repairs or cleaning; she passes through D, and by Means of the Lock 8, she rises into the Basen R, whose Water is four Feet higher than D, and five Feet higher than the Sea. She passes through Basen R into one of the Docks 9, the Gate of which is then shut, and by this Time the Tide must be ebbed more than one Foot; she will therefore be laid dry in the Dock in which she is, by the Ebb of Tide, that is in about four or five Hours, by Means of the Drain 10, which communicates with the Conduits in the West Pier; and was a Ship in each of the Docks 9, they would be both dry at the same Time, by the same Drain, it communicating with them both, and any Number being in the Royal Basen R, they may Dock successively, and each be dry the next Ebb. This Basen is near four Acres, which I apprehend will receive from twenty to thirty Ships and Frigates. We will now follow the Merchantman into Basen D, and will suppose that she wants Repairs; she then passes through a Lock at 4 in Basen D into the present Basen B, and to the Dock 11, where she will be laid dry the same Ebb by Means of the Drain 12, which communicates with the Conduits in the East Pier, admitting other Ships to be coming in that want to Harbour only; then if there is no Birth in Basen D nor B, they pass into P, in which we will suppose the Water is something higher than in B, then the Passage is made by Means of the Lock 13; and now, supposing that another Vessel wants to be docked, then the Gates pointing to Sea in the Lock 2, are shut, and it is laid dry in the same Ebb; then the Lock 3 will become the common Passage till the Vessel is out of 2. It is to be observed, that here is Provision made for docking four Ships in one Tide, and laying them all dry the next Ebb, and keeping them all dry so long as they want to be in the Docks, by a new and peculiar Construction; the Importance of such Convenience, (there

not being a dry Dock upon the Coast, between the River and *Portsmouth*) is almost inestimable, it being well known, that for want thereof, many Lives and Ships have been lost. We will suppose, that 'tis so near high Water at Sea, and that the Tide does not rise within a Foot, two, or three up to the Level of the Water in *Bafon D*; and that 'tis blowing Weather at Sea, and that such Number of Ships are seen making for the Harbour, which could not pass through the Locks 2 and 3 soon enough to save their Tide into the *Bafon*; then the Water in *Bafon D* is levelled with the Sea, and the Passages 15, or the Gates of the Locks 2 and 3, or any, or all of them are opened, for the speedy Passage of many Vessels into the *Bafon*, which when in, the Passages are shut, and *Bafon D* is re-filled immediately from the other *Bafons*; in this Case, had many Ships been in *D*, which had but just Water before, they could not have received any Injury by grounding for the Want of two or three Feet Water only, for an Hour, or less.

We will now suppose the *Bafons* all full of Ships, or that three or four hundred Sail only are in them, and that the Wind comes fair for sailing, in that Case the Waters are all levelled with the Sea, and all the Passages, such as Lock 13, the Gates 5 in the Cross Wall, the Lock 8, the Passages 15, and the Locks 2 and 3 in the Head Wall, and a speedy Egress is obtained for the Whole, and then the *Bafon* R and B and the Pent are all shut for receiving the Rivers Water, in Store for running, as has been described, that a Power sufficient may never be wanted, in Case a Bar should form

In describing the Use to be made of the several *Bafons* and Pent for supplying *Bafon D* with Spring-Tides Water in the Time of Neaps, and that for doing of which, 'tis necessary to keep them all full to four Feet above Spring Tides; having made mention of sinking the Pent four Feet lower than the Cell of the present Cross Wall, shall now give my Reasons for the Necessity thereof; the Contents of the Pent being seventeen Acres, which will, I apprehend, contain three or four hundred Sail of Vessels, and that I must, when I reflect on the favourable Situation of *Dover* Harbour, for receiving Ships from the destructive Downs, imagine that all the Departments will sometimes be nearly filled, among such Number, the Pent must have many large ones, and if during the Time they are there, a Necessity should happen of drawing all the Waters down to the Height
of

of a Spring Tide, then there would remain in the Pent only sixteen Feet Water, if its Bottom was no lower than the Crofs Wall Cell, therefore many of the Ships must ground ; whereas, if it was sunk as mentioned, there would then be twenty Feet, which would float them all ; for the like Reason, I propose that the present Bason should be sunk three or four Feet, as has been mentioned.

Shall observe what great and beneficial Consequences must arise to the Nation at large from the General Plan being carried into Execution, abstracted from the giving Safety to so many Ships, and therefore preserving many Lives and vast Property, and the Importance of it to the Trade in a *French* War, by giving it the readier Assistance of King's Ships and Cruisers, for as (the Crofs Wall excepted) the Whole of the present Works are done with Timber, which extend from the Crofs Wall, and are represented by the bold dotted Lines which terminate by a Bar at the Mouth, signified by small Dots, and in the present State there is not so little as four thousand Loads of converted Prime Timber, fit for Ships of large Size, and much of it is at all Times in a very bad State, it must therefore appear what a Loss the Nation sustains in so much Timber being misapplied, I cannot help using that Term, for Works of this Kind should be done with Stone, which in the same Situations would last for many Ages, where Timber will be decayed in a few Years, and I know, by Experience, that Stone Work would be cheapest at first Cost, and would be supported at an Expence not worth mentioning, and thereby the Harbour in Time be relieved from much of its Expence ; 'tis proposed, that the Works in the General Plan should be done with good hard Stone on the Outside, and set with good and durable Cement, and the inner Parts filled with cheaper Materials, such as squared Chalk and Bricks, all set with such Cement as will harden and become tenacious, although of a cheaper Composition than the Face Mortar, the Whole therefore might be justly considered as a solid Rock, and in the Execution of the Work, the present Timber might be applied for Piles, &c. in the Foundations, and for many other Purposes ; and the vast Quantity of rough Stone, which is now used, as filling up between the Timber Work, might be used in the Inside of the new Works.

I am,

My LORD, and Honourable GENTLEMEN,

Your obedient humble Servant,

Southwark, 1777.

JOSEPH NICKALLS.

JOSEPH H. MICKLETT

A T A B L E,

Shewing the Number of Tons of Water produceable by the present Construction of the Harbour and Pent, using the Whole at a Dead Neap, and each successive Tide, to the Springs. And the like by the general Design, with their Difference, and the superior Effect which will be produced by the designed Number, arising from the Difference of the Size of the present outward Harbour, compared to the designed one.

	Present Tons.	Designed Tons.	Difference in whole Num- bers and De- cimals.	Superior Effect.
Dead Neap — — — — —	47164	156442	3,3	5,7
First Tide after — — — — —	53512	160060	3,	5,1
Second Ditto — — — — —	59917	163677	2,7	4,6
Third Ditto — — — — —	66207	167378	2,5	4,3
Fourth Ditto — — — — —	72555	170913	2,3	3,9
Fifth Ditto — — — — —	79189	174531	2,2	3,8
			12,7	21,7
Sixth Tide after — — — — —	85250	178434	2,	3,4
Seventh Ditto — — — — —	91598	181766	1,9	3,2
Eighth Ditto — — — — —	97660	185384	1,9	3,2
Ninth Ditto — — — — —	104294	189002	1,8	3,1
Tenth Ditto — — — — —	110928	192619	1,7	2,9
			9,3	15,8
Eleventh Tide after — — — — —	117985	196233	1,4	2,4
Twelfth Ditto — — — — —	121190	199855	1,6	2,7
Thirteenth Ditto — — — — —	133252	203473	1,5	2,5
Fourteenth Ditto — — — — —	140309	207090	1,4	2,4
Fifteenth Ditto — — — — —	142033	210994	1,4	2,4
Total of the last five Tides — — — — —			7,3	12,4
Total of the first five Tides, brought down — — — — —			12,7	21,7
Total of the second five Tides, brought down — — — — —			9,3	15,8
Agregate — — — — —			29,3	49,9
Total of the Dead Neap, brought down — — — — —			3,3	5,7
Total of the whole Set of Tides — — — — —			32,6	55,6

It is to be observed, that the Quantity that would be produced by the greater Plan in the first 5 Tides after Dead Neap, would be 12,7 Times more than the present, and that the Effect would be 21,7 Times greater.

That in the next 5 Tides a greater Quantity of 9,3 Times, and greater Effect 15,8 Times.

That in the next 5 Tides a greater Quantity of 7,3 Times, and greater Effect 12,4 Times.

Adding the Dead Neap's Difference, then, in a Set of Tides, the Quantity by the Design would be greater than the present 32,6 Times; and the Effect 55,6 Times greater.

At the same Time that this superior Quantity and Effect were produceable, if wanted, that then the Pent P, A, containing 17 Acres, and 20 Feet Depth of Water; the Royal Basin R, containing near 4 Acres, and 24 Feet and an half Depth of Water; the present Basin B, containing full 5 Acres and an half, and 19 Feet Depth of Water, in the Whole 26 Acres and an half, which would ride four or five hundred Sail of Ships, and be accessible, at all Times, when the Tide served to render the Harbour so; from which it must appear that the Harbour, although 8 Feet and an half greater accessible Depth of Water were added, could never more be stopped.

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At the same time that this question of the right of the
State to the land was being decided, the State of
Alabama, and the State of Georgia, were both
suing the United States for the same land. The
United States was claiming that the land was
owned by the United States, and that the
State of Alabama and the State of Georgia
were both claiming the land. The United States
was claiming that the land was owned by the
United States, and that the State of Alabama
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